Introduction to Effects Based Operations

Information Institute 5th Anniversary Workshop

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Outline

- **Effects Based Operations Defined**

- **AFRL EBO Advanced Technology Demonstration (ATD)**

- **Software Tool Development In Support of EBO**

- **Basic and Applied Research In Support of EBO**

- **Research Areas of Interest**
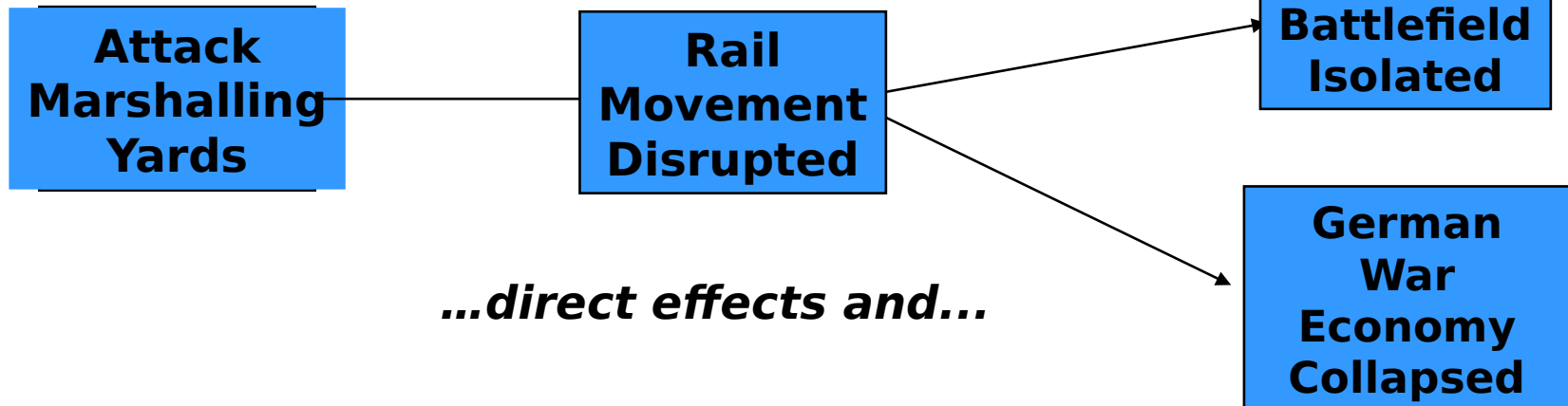
Effects-Based Operations

"Effects based operations is a methodology for planning, executing and
assessing operations to attain the effects required to achieve desired
national security objectives."   **AFDD 1**

Actions cause..   *..indirect effects*

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┌──────────────┐      ┌──────────────┐                ┌──────────────┐
│   Attack     │      │     Rail     │──────────────→ │   Normandy   │
│ Marshalling  │──────│   Movement   │                │  Battlefield │
│    Yards     │      │   Disrupted  │                │   Isolated   │
└──────────────┘      └──────────────┘ ──┐            └──────────────┘
                                          └──────────→ ┌──────────────┐
           *…direct effects and…*                      │    German    │
                                                       │     War      │
                                                       │   Economy    │
                                                       │  Collapsed   │
                                                       └──────────────┘
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The challenge is predicting & assessing what physical actions

AFRL EBO ATD Background

- **Operationally Oriented Framework for EBO**
  - **Warfighter Analysis Workshop**
  - **Concept of Operations Document**

- **Tool Development and Integration/Interfacing**
  - **Strategy Development Tool - prototype**
  - **Campaign Assessment Tool - prototype**
  - **ISR Assistant - concept demonstration**
  - **Wargaming - concept demonstration**

- **Schedule: FY01 - FY04**

- **PRDA 00-06-IFKPA**
  - **http://www.if.afrl.af.mil/div/IFK/prda/prda-ma**

- **Transition to AOC Environment**

Strategy Development Tool: Effects-based COA Development

Goal:

Effects-based COA Development

- Identify desired effects

- Identify actionable events & relate them to the effects (establish a cause and effect relationship)

- Develop strategies that maximize the probability of achieving desired effects

- Identify indicators of progress and when are likely to occur

Centers of Gravity(COG)/Target System Analysis

- Model the enemy as a system (COG)

- Cross COG analysis (physical & behavioral)

- Adversary Response/Enemy workarounds

Current Limitations:

COA Development Tools:

- not integrated with COG /target systems
    analysis techniques

- not based on underlying ontology

COG/Target Systems Analysis:

- done in isolation of each another
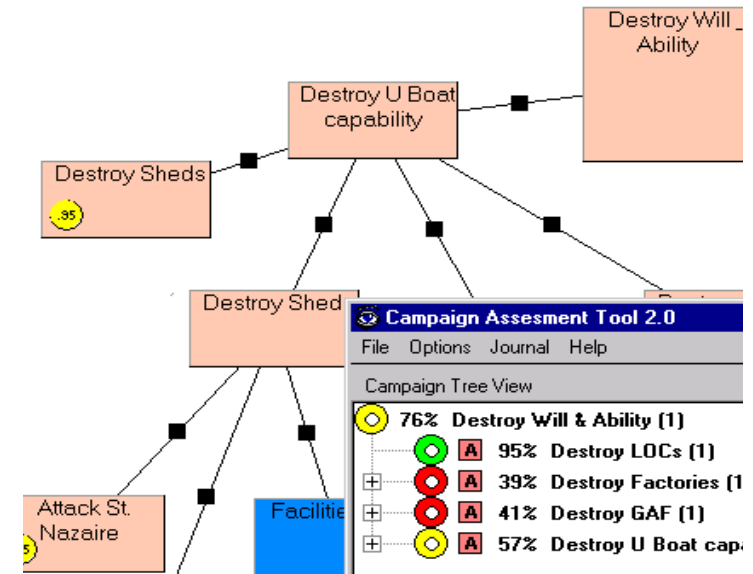
Developers: Alphatech, ISX, PSI

Objective:

Predict probability of achieving Commander's intent (or desired effects) for a Blue COA

Approach:

– Model plan's cause/effects/observables

relations for a given air campaign over time

– Represent and analyze uncertainties in COA

Answers "How well are we doin

– Significantly reduce user inputs with

Developers: AFRL, GMU, Rockwell

sacrificing model integrity

Wargaming

Objective:
Real-time evaluation of blue vs red COA
through simulated execution and
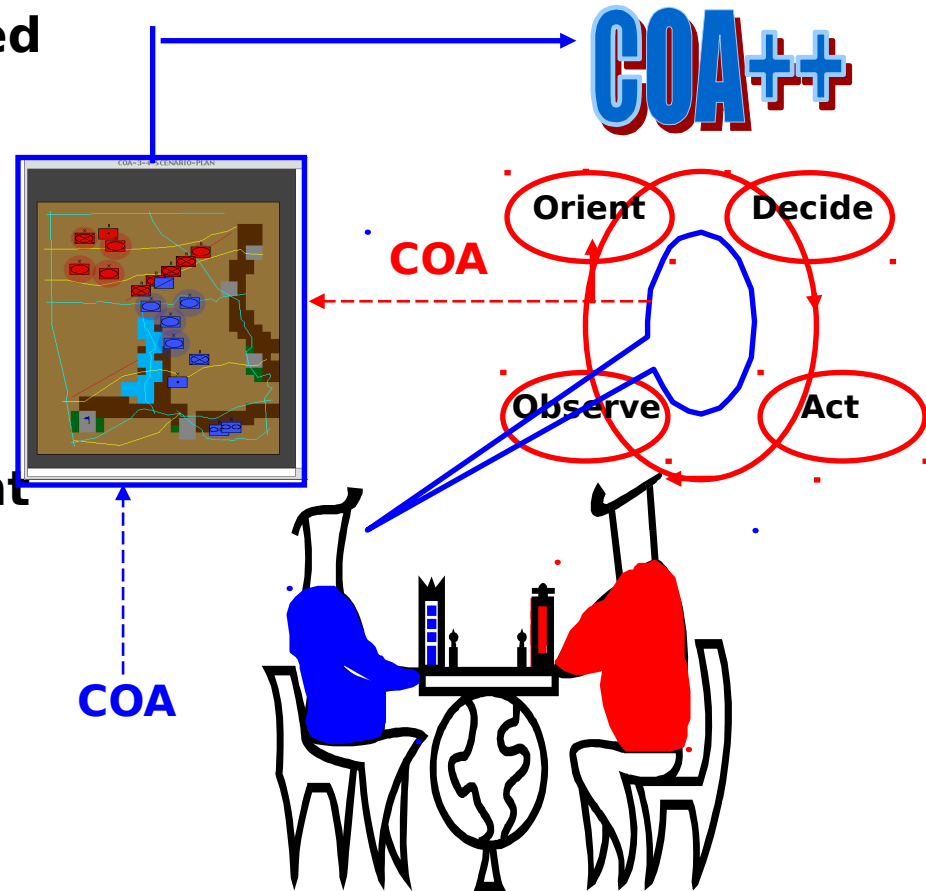**assessment**

Approach:
– **Integrate analytic simulation in**
    planning, extending environment used
    by commanders in military education
    & strategic planning
– **Extend AF Infrastructure Investment**
    tailored to EBO solution
– **Us~~e operational data~~ta for near-**
    real time scenario
– **Integrate COA mechanisms across**

Developer: Emergent

COA++

COA

Orient   **Decide**

Observe   **Act**

COA

ISR Assistance

Objective:
Assess the probability that given ISR assets will be able to identify direct & indirect effects in the battlespace

Approach:

 – Optimize ISR coverage based on various types of effects to be observed

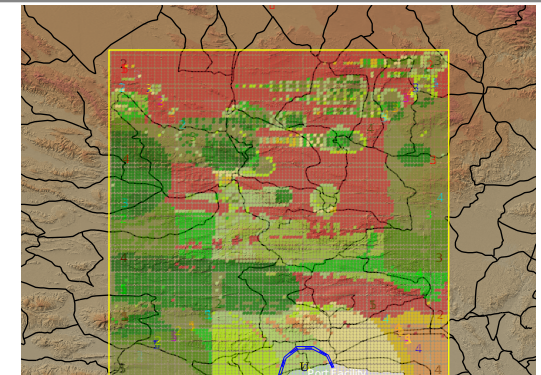 – "Optimal ISR asset coverage based upon effects to be observed"

JSTARS

UAV   SBR

"No Move Zones"

Capability	Source
• Global Coverage	DII/SBR
• Battle Management	RTIP
• Sensor-to-Shooter	ASTOR
• Plan, Deploy, and Update	JSTARS
• Continuous Target Tracking	UAV
• High speed/high capacity data links	U2AIP
	ARLM/ACS

Information Confidence Value Key

1 .9 .8 .7 .6 .5 .4 .3 .2 .1 0

Developer: SAIC

Basic and Applied Research in Support of EBO

- **Models of Defeat for EBO (UMass)**
  - Basic research initiative (6.1)
  - Based in nonlinear dynamics and info theory
  - University of Massachusetts

- **Adversary Intent Inference for Predictive Battlespace Awareness (**
  - Applied Research Initiative (6.2)
  - Theory and computational models
  - University of Connecticut and Lockheed Martin

- **COA Development for Time Critical Targeting**
  - Applied Research Initiative (6.2)
  - Effects-based COA development for TCTs/software agent focus
  - Alphatech

- **Process Assessment and Metrics for EBO**
  - Phase II SBIR
  - Develop MOEs, MOPs, MOMs to measure success of EBO
  - Aptima

Research Areas of Interest for EBO

- **Adversary intent modeling**

- **Course of action wargaming**

- **Enemy defeat modeling**

- **Temporal representation of effects**

- **Real-time simulation interaction**

- **Cross center of gravity analysis and modeling**

- **Prediction of direct and indirect effects**

- **Evidence accrual to determine indicators of eff**